

**FIRST SEMI-ANNUAL 2000
GROUNDWATER AND TREATMENT SYSTEM
EVALUATION REPORT
HARLAN, KENTUCKY**

**Prepared for:
COOPER INDUSTRIES
HOUSTON, TEXAS**

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1.0 INTRODUCTION

1.1 SITE LOCATION

The National Electric Coil (NEC) facility is situated on approximately four acres and is located in Dayhoit, Harlan County, Kentucky (Figure 1). The facility is bordered to the west by former U.S 119, to the east by the Cumberland River, to the north by an emergency utility substation, and to the south by a trailer park property. The facility is surrounded by a large chain-link fence and is occupied by a main plant building, several smaller storage buildings, and a boiler house (Figure 2). Figure 3 shows the complete site, including the offsite properties and the location of the Cumberland River that flows generally east to west.

1.2 SITE HISTORY

The facility was originally opened in 1951 by the McGraw-Edison Company (McGraw-Edison) and operated as a rebuilding and remanufacturing facility for coal mining and related industrial equipment including electric motors, rewinding electric coils, manufacturing, general machine shop work, and mining equipment repair. McGraw-Edison owned and operated the facility until 1985 when Cooper Industries (Cooper) purchased McGraw-Edison as a wholly-owned subsidiary. McGraw-Edison continued to operate the NEC facility until August 1987. The Treen Land Company of Brookside, Kentucky purchased the NEC building and property in August of 1987 and the operations were reopened as the National Electric Service Company. The facility operates under the National Electric Services Management Group, owned by Charles Dozier, for motor repair work and limited rebuilding of hydraulic systems for the coal industry.

1.3 SITE ENVIRONMENTAL ACTIONS

In October 1990, the United States Environmental Protection Agency (USEPA) issued a Unilateral Administrative Order (UAO) (USEPA Docket No. 90-57-C) requiring immediate actions designed to mitigate the release of hazardous substances from the site. Cooper subsequently contracted with Law Engineering & Environmental Services (Law) to develop and implement a Remedial Action Plan (RAP) in accordance with USEPA's UAO. As part of the RAP, Law installed monitoring wells at the site to evaluate the magnitude of the groundwater contamination.

The NEC site was proposed for inclusion on the National Priority List (NPL) on July 29, 1991 and the site was placed on the NPL on October 14, 1992. USEPA and Cooper entered into an Administrative Order by Consent for a Remedial Investigation/Feasibility Study (RI/FS) in May 1992. The USEPA issued a UAO on December 15, 1992, directing Cooper to perform the Interim Remedial Design/Interim Remedial Action (RA) described in the Record of Decision (ROD) concurrently with the RI/FS to capture groundwater containing chlorinated volatile organic compounds (VOCs).

The original groundwater recovery and treatment system was activated in July 1993 and consisted of an on-site Recovery Well CMW-5-11 located in the deeper bedrock aquifer zone (~120 feet), an equalization tank, an air stripping tower, and a 10,000 pound activated carbon unit to treat the air stripper off gas.

An additional RA was implemented at the site to address impacted groundwater in accordance with the April 26, 1996 ROD and May 20, 1996 UAO issued to Cooper by USEPA. A RA Report (March 4, 1998) was submitted to document the

implementation and initial start-up activities associated with the RA system. The RA system consisted of the installation of groundwater recovery systems located in the shallow alluvial aquifer and the intermediate and deeper zones of the underlying bedrock aquifer, and the installation of a treatment system to remove the VOCs from the extracted groundwater using air stripping technology. The air stripper off gases are treated through a catalytic oxidation system prior to being discharged into the atmosphere via a 60-foot tall air stack.

The final groundwater recovery system consisted of the installation of four recovery units: an interceptor trench located in the shallow alluvial aquifer (approximately 190 feet long and 24 feet deep); Recovery Well R-2 located in the intermediate bedrock aquifer zone (approximately 80 feet deep); Recovery Well CMW-5-2A located in the deeper bedrock aquifer zone (approximately 125 feet deep); and existing Recovery Well CMW-5-11 (approximately 120 feet deep) located in the deeper bedrock aquifer zone.

The final groundwater treatment system consisted of a 2,000-gallon double-walled equalization tank, the existing air stripper tower, and a catalytic oxidation system to treat the off gases from the air stripping tower. Treated water flowing at an average of 176 gallons per minute (gpm) from the air stripper continues to be discharged to the Cumberland River in compliance with the requirements of a KPDES permit. The layout of the remediation system is shown on Figure 2.

The final RA implementation was conducted between September 1997 and February 1998. The final groundwater recovery systems and the catalytic oxidation unit started up in February 1998.

1.4 CONTAMINANTS OF CONCERN

Historically, several VOCs have been detected in the groundwater samples collected from the site, however the contaminants with the highest concentrations detected include cis-1,2-dichloroethene (DCE), trichloroethene (TCE), and vinyl chloride. Tetrachloroethene (PCE), 1,1-DCE, benzene, 1,1,2,2-tetrachloroethane, and toluene have also been detected in the past at elevated concentrations in select wells. The contaminants of concern and their respective maximum contaminant levels (MCLs) are listed below:

Contaminant	MCL (.g/l)
TCE	5
Cis-1,2-DCE	70
Vinyl Chloride	2
1,1-DCE	7
PCE	5
Benzene	5
Toluene	1,000

No MCL exists for 1,1,2,2-tetrachloroethane.

2.0 SEMIANNUAL ACTIVITIES

2.1 SYSTEM OPERATION AND MAINTENANCE

In order to ensure proper operation of the remediation system, Shield Environmental Associates (Shield), of Lexington, Kentucky conducts routine monthly monitoring of the groundwater remediation system. The operations and maintenance of the groundwater remediation system are performed by Eastern Well & Pump. Table 1 summarizes the maintenance conducted from January through June 2000. No major problems were encountered during the period except for routine maintenance activities.

2.2 INFLUENT AND EFFLUENT WATER SAMPLING

Operation of the RA system is subject to federal and state requirements. The KYDEP Water Resources Branch, Division of Water, in a letter dated March 6, 1996, set forth the requirements for the NEC site for the pumping of groundwater from the three aquifer zones. The authorization letter permits total recovery rates ranging from 100 gpm (0.144 million gallons per day [mgd]) to a maximum of 250 gpm (0.360 mgd) from all of the aquifer zones. The groundwater recovery system is typically pumped at an approximate combined average rate of about 176 gpm.

Monitoring of the discharged groundwater has continued during the operation of the RA to demonstrate continued compliance with the KPDES requirements. A KPDES permit was granted for the discharge of water from the treatment system and is effective from February 1, 1997 through February 1, 2002. A modified permit was issued by the KYDEP on December 20, 1999 and became effective on February 1, 2000. The new permit allows monthly monitoring of the effluent water

and the elimination of the diffuser pipe. The new permit, included in Appendix A, establishes discharge limitations and monitoring and reporting requirements, which are summarized in Table 2.

The air stripper influent water samples are being collected on a quarterly basis to monitor the treatment efficiency of the air stripper. Prior to February 2000, samples were collected monthly. Post-treatment effluent water discharging to Outfall 001 was sampled on a weekly basis in January 2000 prior to initiation of the new KPDES permit. One sample was collected in February, April, and May to comply with the KPDES permitting requirements for monthly sampling. A total of three samples were collected in March 2000 to obtain a monthly average concentration for cis 1,2-DCE.

Influent and effluent water samples were analyzed for VOCs using USEPA Method 8260. Severn Trent Laboratories, Inc. (Severn Trent) in Amherst, New York and Houston, Texas performed the laboratory analyses in the past. Antech out of Export, Pennsylvania, is the current laboratory. CEC is performing the sampling and monitoring work (see attached brochure on CEC and Antech).

2.3 INFLUENT AND EFFLUENT AIR SAMPLING

The KYDEP has not established limits for air emissions from the treatment system and does not require an air permit. However, the USEPA has developed emission rates and ambient air performance standards for the RA system, shown on Table 7. Performance standards, were established in the ROD with limitations on the discharge of TCE, cis-1,2-DCE, and vinyl chloride. The point of compliance for the emission rate standards is the discharge end of the 60 foot air exhaust stack after the catalytic oxidation unit.

The air emissions exiting the air exhaust stack were monitored during the initial start up of the RA system to demonstrate compliance of the off-gas catalytic oxidation treatment system with the EPA emission rate performance standards. Monitoring of the air exhaust emissions exiting the stack has continued on a monthly basis during the operation of the RA to demonstrate continued compliance with the air emission performance standards.

The groundwater recovery off-gas treatment system operated continuously during the first semiannual period. Samples of the influent and effluent air stream to the catalytic oxidation unit were collected in summa canisters by Shield Environmental on a quarterly and monthly basis, respectively, and analyzed by Severn Trent in Houston, Texas for VOCs using USEPA Method TO-14.

2.4 GROUNDWATER SAMPLING

Cooper conducts routine groundwater monitoring on a semiannual basis. The purpose of these activities is to evaluate the concentrations of VOCs in groundwater with respect to time and to measure the effectiveness of the groundwater recovery and treatment system. The groundwater monitoring system for the NEC site is summarized in Table 3.

The first semiannual sampling event was conducted on April 4 and 5, 2000 by Shield Environmental Associates, Inc. (Shield) of Lexington, Kentucky. It was later discovered that the system was not performing at optimal conditions during the sampling event. Therefore, selected wells were resampled on May 16, 2000 by Sheild. A summary of the monitoring events is presented below:

April 4 and 5, 2000:

- Measurement of groundwater levels at 21 monitoring wells
 - Six in the shallow aquifer (BH-0 through BH-5)
 - Four in the intermediate aquifer (CMW-5-11A, CMW-5-11B, CMW-12, and R-2)
 - Eleven in the deep aquifer (CMW-5-0, CMW-5-2, CMW-5-10, CMW-6, CMW-7, CMW-9, CMW-12A, MW-13, CMW-85, CMW-87, and CMW-127)
- Sampling the Interceptor Trench and recovery wells R-2, CMW-5-2A, and CMW-5-11
- Purging and sampling of groundwater from nine monitoring wells (CMW-6, CMW-7, CMW-9, CMW-5-2, CMW-5-2A, CMW-85, CMW-12, CMW-12-16, and CMW-13)
- Collection of four QA/QC samples (Trip Blank, Equipment Blank, Blind Duplicate (CMW-5-2), Field Blank)
- Analysis of the groundwater samples and QA/QC samples for VOCs by USEPA Method Contract Laboratory Program (CLP) Statement of Work (SOW) OLM 0.30

May 16 through 18, 2000:

- Measurement of groundwater levels at seven monitoring wells:
 - One in the intermediate aquifer (CMW-12)
 - Six in the deep aquifer (MW-6, MW-7, MW-9, CMW-12-16, CMW-13, and CMW-85)
- Sampling the interceptor trench and recovery well R-2, CMW-5-2A and CMW-11

- Purging and sampling of groundwater from seven monitoring wells (MW-6, MW-7, MW-9, CMW-12-16, CMW-13, and CMW-85)
- Collection of one QA/QC sample (Trip Blank)
- Analysis of groundwater samples and the QA/QC sample for VOCs using USEPA Method Contract Program (CLP) Statement of Work (SOW), OLM 0.30.

Standard USEPA monitoring well sampling procedures and protocols were followed. Initially, groundwater levels were measured within each monitoring well in order to determine groundwater elevations for the development of groundwater elevation contour maps and to delineate groundwater flow directions. The groundwater monitoring well sampling locations are shown on Figure 4.

Prior to sampling the monitoring wells, a minimum of three well volumes of water was removed from the wells and disposed of through the treatment system. Samples for laboratory analysis were collected in laboratory-prepared VOC glass vials containing an appropriate amount of preservative. Zero headspace was attained for each VOC sample vial, and samples were properly labeled and packaged for shipment to the analytical laboratory in shuttles containing ice packs. Standard chain-of-custody protocol was strictly adhered to during all phases of sample collection, transport, and delivery to the laboratory. Antech Ltd. of Export, Pennsylvania, analyzed the groundwater samples.

During the April sampling event, four QA/QC samples were collected and includes a trip blank, equipment blank, blind duplicate and field blank. A trip blank was analyzed during the May sampling event. The trip blanks were prepared by the analytical laboratory prior to shipping the sample bottles, and accompanied the sample bottles throughout the entire sampling process. The equipment blank was

collected by pouring deionized water over sampling equipment after it had been decontaminated to evaluate the effectiveness of the decontamination procedures. The blind duplicate sample, from MW-5-2, was collected to evaluate the laboratory analytical procedures and the field blank was collected to evaluate the ambient air conditions at the time of sampling.

3.0 FINDINGS

3.1 SYSTEM PERFORMANCE

The groundwater recovery system operated almost continuously during the first semiannual 2000 monitoring period. The remediation system was inoperable on March 27, 2000 for routine system maintenance and reportedly shut down some time after May 17, 2000 for a short period of time due to a suspected bad airflow sensor. The system was repaired and returned to operations later in the day.

The recovery system treated and discharged over 45 million gallons during this reporting period (January 1, 2000 through July 5, 2000) from the combined aquifers (Table 4). The approximate monthly flow rate from the shallow aquifer (interceptor trench) was 1 gpm; from the intermediate bedrock aquifer (R-2) approximately 25 gpm; and from the deep bedrock aquifer approximately 150 gpm. Based on these measurements, the combined pumping rate was approximately 176 gpm, which is within the KPDES permit range requirement of 250 gpm.

3.1.1 Influent Groundwater Sampling

Influent samples are generally collected on a quarterly basis and are used to evaluate the efficiency and removal rates of the RA system (Sections 3.1.2 and 3.1.3). During this semi-annual monitoring period, influent samples were collected in April and May. No influent samples were collected in March 2000; therefore the analytical results from samples collected from each of the extraction points (Interceptor Trench Sump, R-2, CMW-5-LA, and CMW-5-11) and the rates were used to calculate the influent concentrations in the system (Table 4).

As shown on Table 5, the combined air stripper influent water sample had TCE ranging from 18 .g/l to 144 .g/l that were collected during the first sampling semiannual sampling period. The influent samples also were found to contain 1,2-DCE ranging from 397 to 522 .g/l and vinyl chloride from 27 to 43 .g/l. The analytical results for the influent are consistent with previous sampling of the influent groundwater.

3.1.2 Effluent Groundwater Sampling

Effluent water samples from the treatment system detected the presence of cis 1,2-DCE. Three effluent samples collected during March had a monthly average value of 56 .g/l, below the average discharge limit, and well below the daily maximum limit of 120 .g/l. TCE was occasionally detected in the effluent samples and ranged from below the detection limit to 10 .g/l, well below the monthly discharge limit of 40 .g/l. Vinyl chloride was not detected in any of the samples above the detection limit. Analysis of the system removal efficiency is also summarized on Table 5. The groundwater treatment system operated at an average removal efficiency of 94.9 percent during this monitoring period.

3.1.3 System Groundwater Contaminant Removal Analysis

Recovered groundwater samples were collected and analyzed for VOCs at the influent point of the treatment system on a quarterly basis prior to March 2000 with the last quarterly sample collected on December 2, 1999. Starting in March 2000, influent samples were collected on a monthly basis. Using the influent sample results and the monthly flow rates, the approximate amount of contaminant removed during the first semiannual sampling event was calculated. The calculations, presented in Table 6, indicate that approximately 227 pounds of total

VOCs were removed from by the treatment system. The 227 pounds includes approximately 178 pounds of 1,2-DCE, 37 pounds of TCE and 12 pounds of vinyl chloride. Since 1993, when the first groundwater recovery system was started, approximately 897 pounds of VOCs have been removed. Approximately 25% of the total VOCs removed since 1993 were removed during this first quarter of 2000.

3.1.4 Off-Gas Treatment System

Table 7 summarizes the air treatment system analytical results for the air stripper exhaust gas (cat-ox influent) and the cat-ox air stack effluent samples. Two influent samples were collected during the first semiannual period, one in January and one in May 2000. Cis 1,2-DCE, TCE and vinyl chloride were detected in the January sample and only cis-1,2-DCE was detected above the detection limit in the May sample, well below the EPA standard as shown on Table 7. The May sample exhibited elevated detection limits due to the presence of dichloromethane, benzene, toluene, tetrachloroethylene, xylene, and acetone. With the exception of TCE in two of the samples (January and February) and cis-1,2-DCE in February, the air emission stack effluent samples were well below the EPA established limits shown on Table 7, and their respective detection limits. However, the detection limits for the March and April sampling events were elevated due to the presence of elevated levels of dichloromethane, tetrachloroethylene, benzene, toluene, ethylbenzene, and xylenes. The air emission influent and effluent results are both well below the EPA standards; therefore, Cooper believes operation of the Cat-ox unit is not required.

Table 7 also presents calculations on the removal efficiency of the cat-ox for the primary contaminants of concern, 1,2-DCE, TCE, and vinyl chloride. Based on the calculations, the removal efficiency of the primary contaminants is almost 100 percent during this monitoring period.

3.2 GROUNDWATER FLOW

Groundwater level measurements were obtained from 20 monitoring wells during this semiannual monitoring event. The groundwater levels recorded in the field were converted to groundwater elevations reported as feet above mean sea level according to surveyed measurement reference point elevations. Groundwater elevation data collected during this monitoring event is summarized in Table 8.

The groundwater elevations were used to generate groundwater contour maps of the shallow, intermediate and deep aquifers. Due to the proximity of the Cumberland River, the natural shallow groundwater flow direction at the site would be east-southeast toward the river; however, the shallow aquifer contour map (Figure 5), generated using the groundwater elevations in the shallow monitoring wells, indicated that the interceptor trench is capturing the shallow groundwater. The contour map of the intermediate aquifer (Figure 6), generated using the groundwater elevations from wells R-2 and CMW-12 in the intermediate aquifer, indicates a cone of depression surrounding the intermediate pumping well, R-2, extending towards well CMW-12, capturing the intermediate groundwater contamination. The groundwater contour map of the deep aquifer (Figure 7) indicates that the groundwater flows generally northward toward the deep extraction wells CMW-5-2A and CMW-11 in the vicinity of the NEC site. The monitoring wells located downriver and closer to the river indicate that the deep groundwater in that area flows more west-northwest, which is similar to the direction of the flow of the river in that location.

3.3 EXTRACTION WELL ANALYTICAL RESULTS

The analytical results for the well and trench samples are summarized on Table 9 and the complete analytical report is presented in Appendix B. One sample was collected from the interceptor trench that removes groundwater from the shallow aquifer. TCE (1800 .g/l) was the only VOC that was detected above its respective MCL. The only other parameter that was detected in the trench was 1,2-DCE at 62 .g/l, below the 70 .g/l MCL for its most common isomer (cis-1,2-DCE). Vinyl chloride was not detected above its respective detection limit in the trench.

Analytical results for the recovery well, R-2, located in the intermediate aquifer detected the presence of three VOCs, 1,2-DCE (1300 .g/l), TCE (590 .g/l), and vinyl chloride (34 .g/l), all above their MCLs.

One sample was also collected from each of the two recovery wells in the deeper aquifer (5-2A and 5-11). Vinyl chloride (31 and 22 .g/l, respectively) and 1,2-DCE (540 and 250 .g/l, respectively) were detected in both of the wells above their respective MCLs. TCE was detected in recovery well 5-2A at 110 .g/l, above the MCL but was not detected in recovery well 5-11.

The presence of 1,2-DCE and vinyl chloride in all three aquifers indicates the occurrence of natural biodegradation at this site. This is a naturally occurring mechanism that will help reduce contaminant concentrations in the groundwater over time.

3.4 OFFSITE GROUNDWATER ANALYTICAL RESULTS

The first semiannual sampling results are summarized in Table 9 and the complete analytical results are presented in Appendix B. Figure 8 also presents a summary of the analytical results.

The VOCs in all of the off-site wells were below their respective detection limits, except for the sample collected from well MW-7, which exhibited concentrations of 1,2-DCE (570 .g/l) and TCE (31 .g/l), both above their respective MCLs. Due to the detection limits, the presence of TCE and vinyl chloride in the wells above their respective MCLs can not be determined (except for TCE at MW-7).

3.5 DATA ANALYSIS

Historical groundwater quality data for Wells CMW-5-2, CMW-5-11, CMW-7, CMW-12, and CMW-85 are presented on the time trend plots in Figures 9 through 13, respectively. The historic analytical database for the site is presented in Appendix C.

Analytical results for the first semiannual 2000 monitoring event, including the April and May data, are in general agreement with the historical data and are showing fluctuation, but overall are showing a decreasing concentration trend. Decreasing trends are attributed to the operation of the RA system and due to the process of natural biodegradation since the time trends indicate decreased concentrations of TCE in comparison to the associated degradation products cis-1,2-DCE and vinyl chloride. Also, based on the concentrations observed in the trench (shallow), R-2 (intermediate), and CM-5-2A and CMW-5-11 (deep), the concentrations of TCE appear to be decreasing with depth in groundwater along

with general corresponding increases in cis-1,2-DCE and vinyl chloride levels indicative of bioattenuation.

3.6 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Methylene chloride (10 .g/l) was detected in the trip blank collected in April and is believed to be a laboratory contaminant. No other parameters were detected. Analytical results for the trip blank were below detection limits for the parameters analyzed in May 2000. No VOCs were detected in the equipment blank or field blank samples. The analytical results of the blind duplicate sample from MW-5-2 were within acceptable limits.

4.0 SUMMARY

4.1 TREATMENT SYSTEM

The groundwater treatment system continues to be effective at removing VOCs from the groundwater extracted from the shallow, intermediate and deep aquifer recovery systems. Approximately 45 million gallons were removed during this period with a combined flow of approximately 176 gpm with a calculated combined recovery of 277 pounds of VOCs. Since startup of the system in February 1998, approximately 897 pounds of VOCs have been removed.

During the period, the system operated at nearly 95% removal efficiency. Analytical records of effluent samples from the system were within KPDES compliance limits.

The off-gases from the air stripper were treated through a catalytic oxidation system. The catalytic oxidation system removed almost 100% of the influent gases of concern (1,2-DCE and vinyl chloride). Influent as well as effluent analytical results met the required EPA limits for the compounds of concern.

4.2 GROUNDWATER FLOW

The three groundwater contour maps generated for the shallow, intermediate and deep aquifers indicate that the recovery system is effectively capturing the contaminated groundwater. In the shallow aquifer, the groundwater appears to be captured by the trench system. The intermediate and deep aquifers appear to have cones of depression around the respective extraction wells that extend beyond the leading edge of the contaminant plumes in each aquifer. This finding indicates that

the system is not only controlling, but also retracting the remaining groundwater contamination.

4.3 ANALYTICAL RESULTS

Samples collected from the extraction points (Trench R-2, CMW-5-2A and CMW-11) detected the presence of elevated concentrations of 1,2-DCE, TCE, and vinyl chloride. However, over time, the concentrations are decreasing. The decrease appears to possibly be from a combination of the effectiveness of the remedial system and the occurrence of natural degradation of the contaminants.

The groundwater sampling collection from the offsite wells in the deep aquifer indicate that offsite migration of contaminants is being controlled by the remediation system. Only one offsite well (CMW-7) exhibited elevated contaminants (1,2-DCE and TCE) at concentrations exceeding their respective MCLs.

5.0 CONCLUSIONS

The groundwater recovery system is effectively removing contaminants from the impacted shallow, intermediate, and deep aquifers. The system also appears to be controlling the offsite migration of the contaminants and retracting the contaminant VOC plume.

The continued operation of the groundwater remediation treatment system along with the monthly monitoring and maintenance of the remediation system will continue to remediate the aquifers and prevent offsite VOC contaminant migration.